What Is Claimed Is:

1. A method of analyzing a biological sample comprising:

preserving RNA in the biological sample by incubating the biological sample with an RNA preservative in an aqueous solution so as to precipitate RNA;

histochemically staining the RNA-preserved biological sample;

histochemically analyzing the biological sample to identify specific cell populations; and

analyzing mRNA expression patterns of the identified cells by a method comprising: in-situ hybridization; or isolating identified cells and subjecting the isolated cells to bioarray gene profiling.

2. A method according to claim 1, wherein the RNA preservative is selected from the group consisting of triphenylmethane dyes, cresyl violet, polyamines, and cobalt ions.

3. A method according to claim 1, wherein the RNA preservative is a triphenylmethane dye selected from the group consisting of methyl green, crystal violet, and pararosaniline.

4. A method according to claim 1, wherein the histochemically analyzing comprises subjecting the biological sample to a histochemical assay selected from the group consisting of: in situ hybridization for detecting mRNA; fluorescence in-situ hybridization for detecting DNA; immunocytochemistry assay for detecting proteins; enzyme histochemistry assay for measuring

catalytic activities of enzymes; ligand-binding autoradiography for studying receptor-ligand interactions; and glycohistochemistry assay for detecting carbohydrate-modified substances.

5. A method of analyzing a biological sample comprising:

(a) contacting the biological sample with an RNA-preserving solution comprising an aqueous solvent and an RNA preservative;

(b) incubating the biological sample with a buffer solution comprising an aqueous buffered solvent and a binding agent capable of binding to the biological sample;

(c) detecting the binding agent bound to the biological sample; and

(d) identifying a target cell or tissue within the biological sample based on the binding pattern of the binding agent bound to the biological sample.

6. A method according to claim 5, wherein the biological sample comprises a cell and the binding agent is a labeled molecule selected from a group consisting of: an antibody capable of binding to an antigen of the cell; a nucleic acid molecule capable of hybridizing to a fragment of DNA of the cell under stringent hybridization conditions; a nucleic acid molecule capable of hybridizing to an mRNA of the cell under stringent hybridization conditions; a lectin capable of binding to a carbohydrate-modified substance of the cell; a substrate to an enzyme of the cell; and a ligand capable of binding to a receptor of the cell.

7. A method according to claim 5, wherein the binding agent is a compound labeled with a radio-isotope, a fluorescent molecule, or biotin.

8. A method according to claim 5, wherein the RNA preservative is selected from the group consisting of methyl green, crystal violet, pararosaniline, tris-(4-aminophenyl)methane, cresyl violet, and hexamine cobalt.

9. A method according to claim 5, further comprising:

(e) contacting the biological sample with a labeled nucleic acid molecule capable of hybridizing to mRNA of the target cell or tissue under stringent hybridization conditions; and

(f) detecting the labeled nucleic acid molecule bound to the target cell or tissue.

10. A method according to claim 9, wherein the RNA preservative is selected from the group consisting of triphenylmethane dyes, cresyl violet, polyamines, and cobalt ions.

11. A method according to claim 5, further comprising:

(e) isolating the target cell or tissue from the biological sample;

(f) extracting mRNA from the isolated target cell or tissue; and

(g) analyzing the extracted mRNA by gene expression bioarray analysis.

12. A method according to claim 11, wherein said isolating the target cell or tissue from the biological sample comprises laser capture microdissection.

13. A method according to claim 11, further comprising amplifying the extracted mRNA from the isolated cell or tissue and labeling the amplification product.

14. A method according to claim 11, further comprising contacting the labeled amplification product with polynucleotide probes on a microarray chip under hybridization conditions sufficient to produce a hybridization pattern of complementary probe/target complexes.

15. A method according to claim 11, further comprising reverse-transcribing the extracted mRNA into cDNA.

16. A method according to claim 15, further comprising amplifying the cDNA by a multiplex polynucleotide chain reaction and labeling the amplification product.

17. A method according to claim 16, further comprising contacting the labeled amplification product with polynucleotide probes on a microarray chip under hybridization conditions sufficient to produce a hybridization pattern of complementary probe/target complexes.

18. A method according to claim 11, wherein the RNA preservative is selected from the group consisting of triphenylmethane dyes, cresyl violet, polyamines, and cobalt ions.

19. A method according to claim 11, wherein the RNA preservative is a triphenylmethane dye selected from the group consisting of methyl green, crystal violet, and pararosaniline.